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Kalt

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[45] **May 30, 1978**

[54] **PUNCH KNOCK-OUT MECHANISM FOR HEADER**

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[73] Assignee: **Kalt Manufacturing Company,** North Ridgeville, Ohio

[21] Appl. No.: **798,615**

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Related U.S. Application Data

[63] Continuation of Ser. No. 659,658, Feb. 20, 1976, abandoned.

[51] **Int. Cl.**[2] **B21D 45/00;** B21K 1/44

[52] **U.S. Cl.** ..... **10/11 E**

[58] **Field of Search** ..... 10/11 R, 11 A, 11 E, 10/12 R, 12.5, 15; 72/427; 74/568

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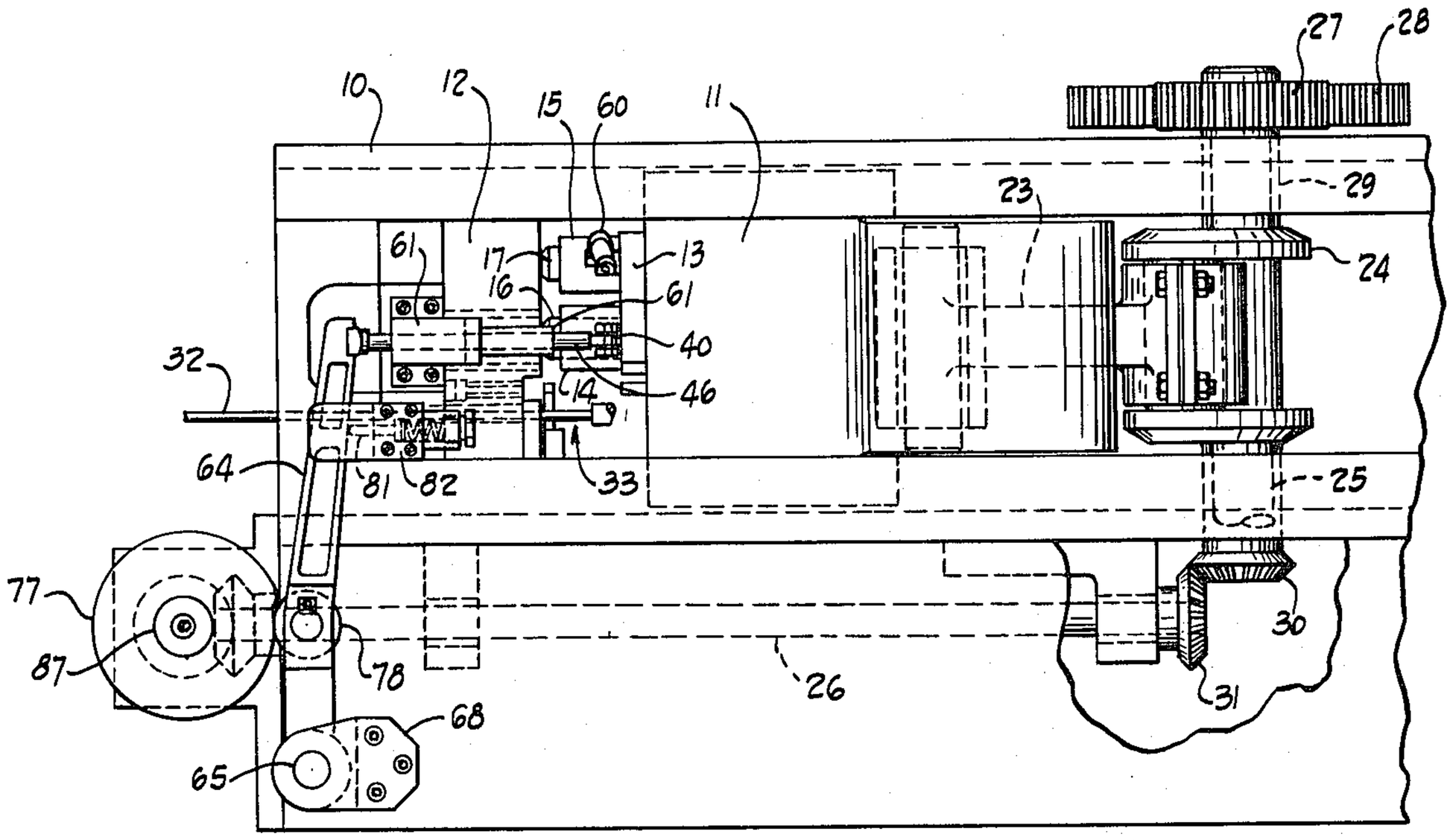
Primary Examiner—E. M. Combs

Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

[57] **ABSTRACT**

A double-blow header, a fixed die, a tool or punch slide, a crankshaft operably connected to the tool slide for reciprocating the tool slide toward and away from the die, a punch carrier movably supported on the tool slide, a plurality of punch assemblies carried by the punch carrier, each of the punch assemblies comprising a punch and punch knock-out pin and a pivoted punch knock-out lever for advancing the punch knock-out pin in the punch when moved in one direction about its pivot, a new and improved punch knock-out actuating mechanism including a reciprocal rod mounted on a fixed part of the machine and extending in the direction of the tool slide, a lever for actuating the punch knock-out levers of the punch assemblies, a pivoted lever arm for moving the reciprocal rod, and an adjustable timing cam operated at one-half the speed of the crankshaft for swinging the lever arm and thereby actuating a knock-out lever of a punch assembly through the rod when the tool slide recedes from the fixed die.

8 Claims, 8 Drawing Figures



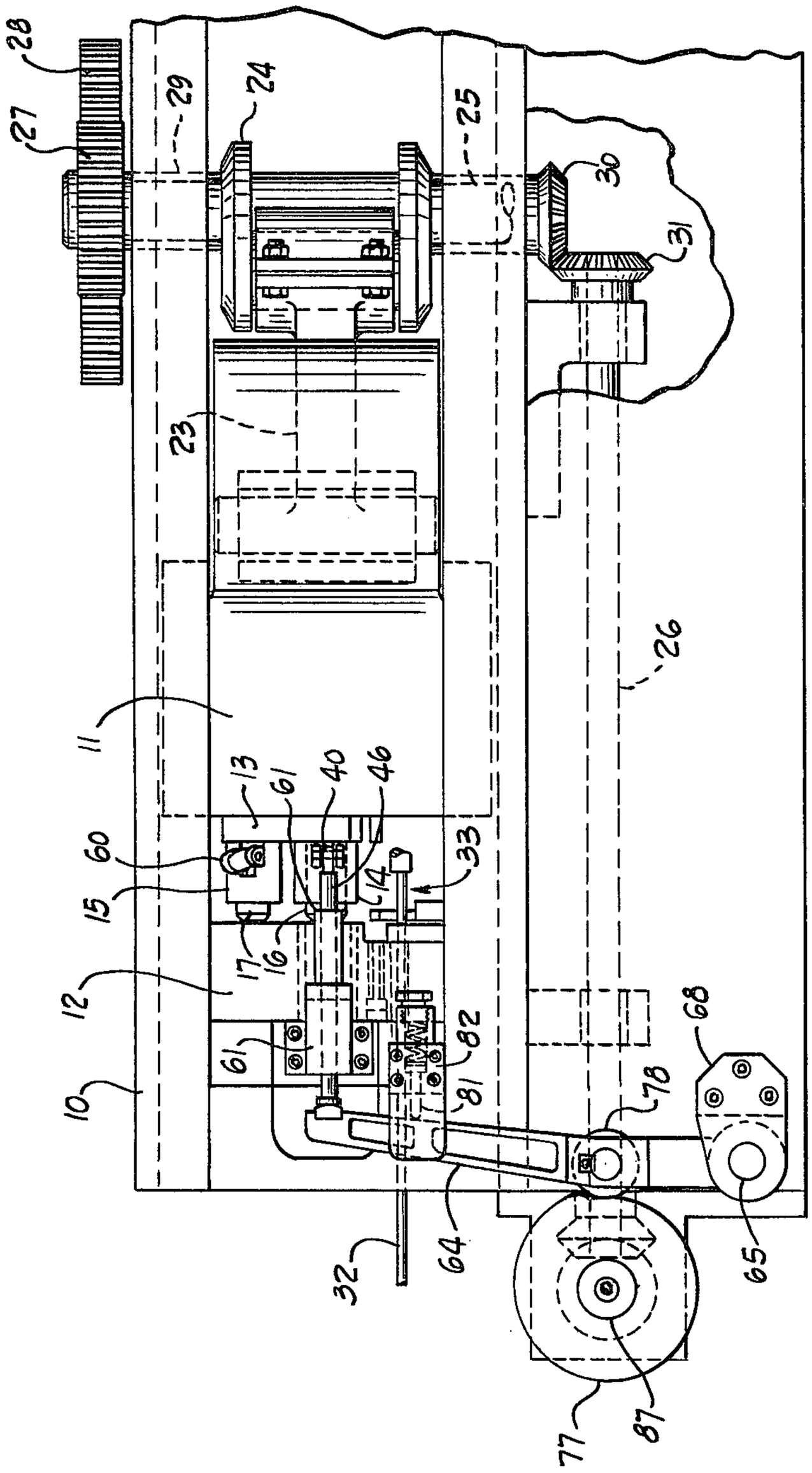

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Fig. 1

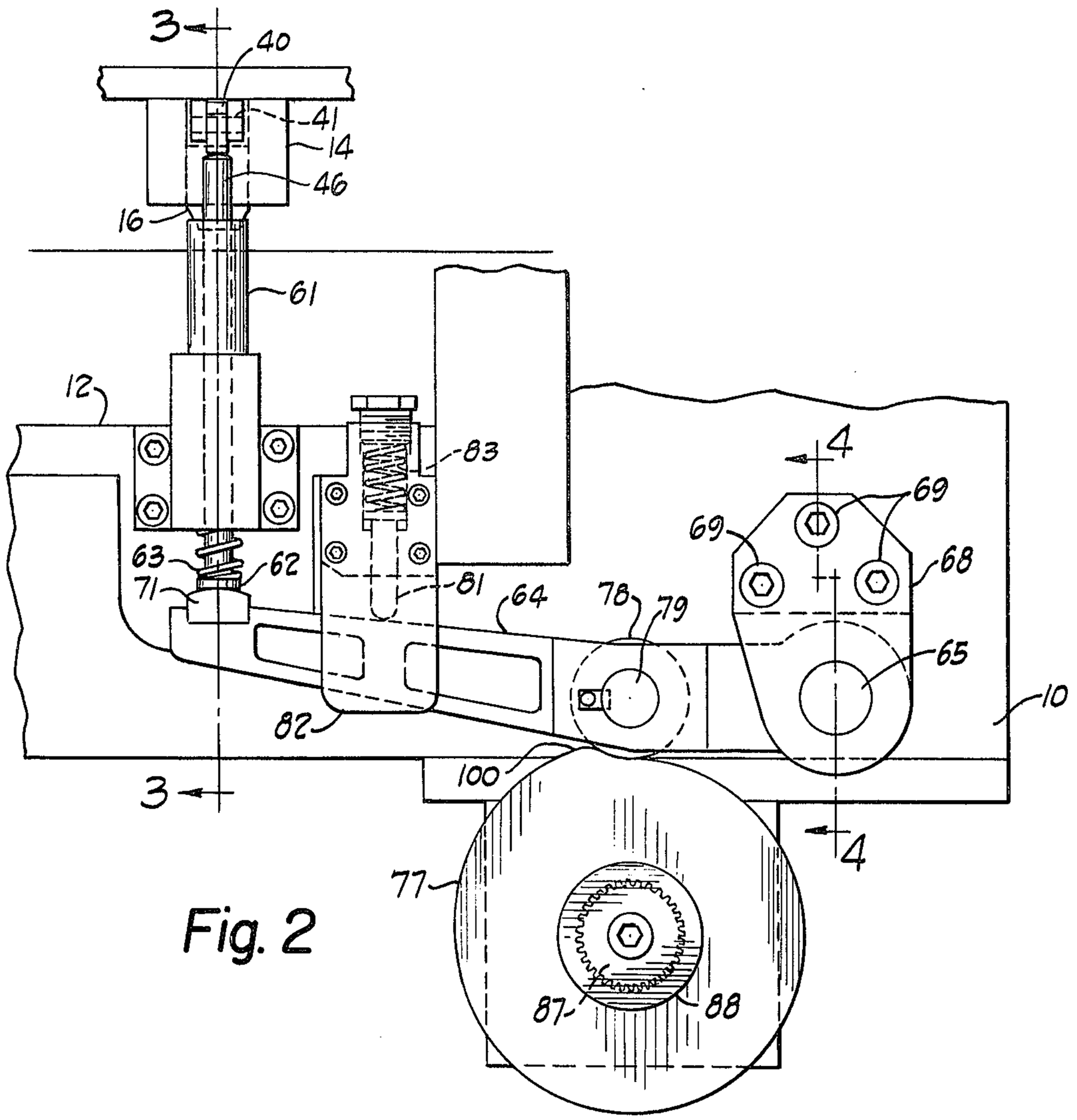

Fig. 2

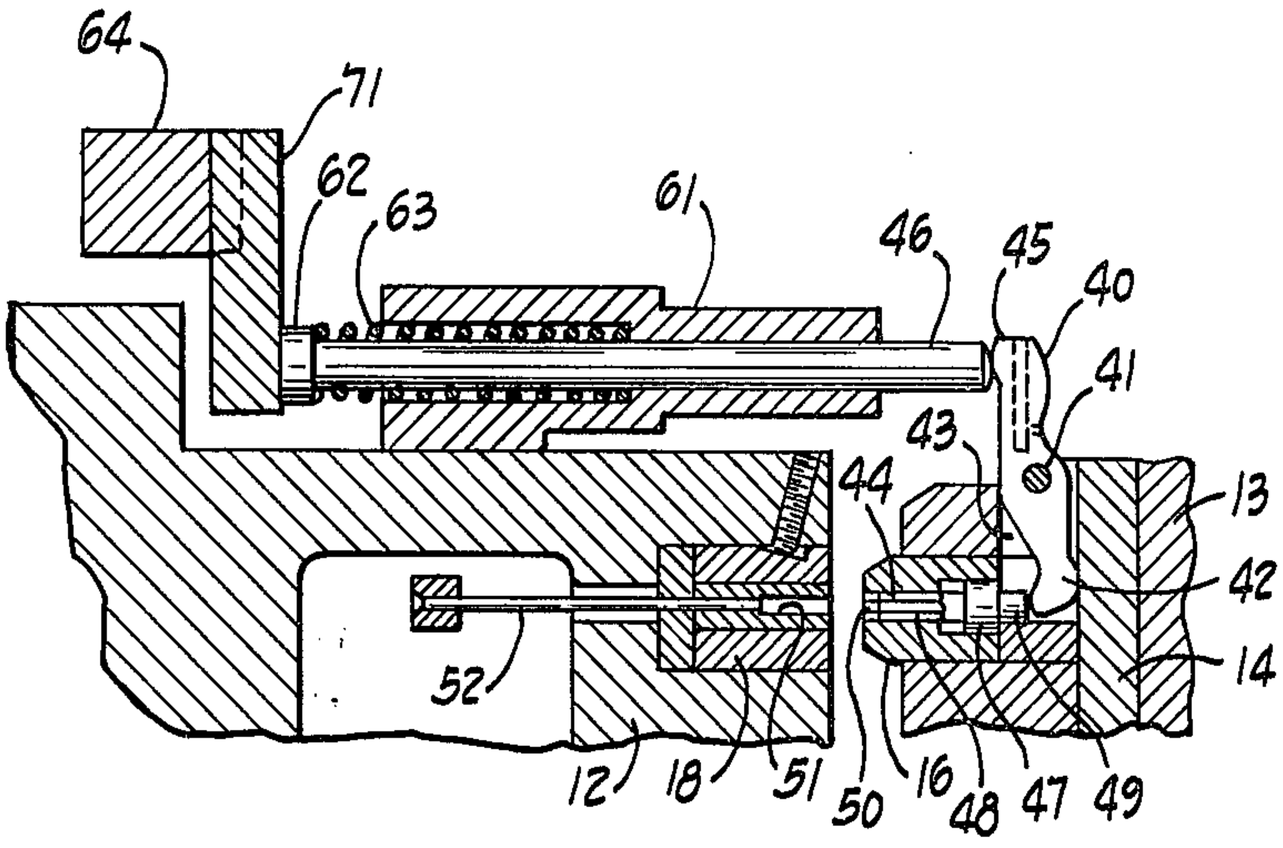

Fig. 3

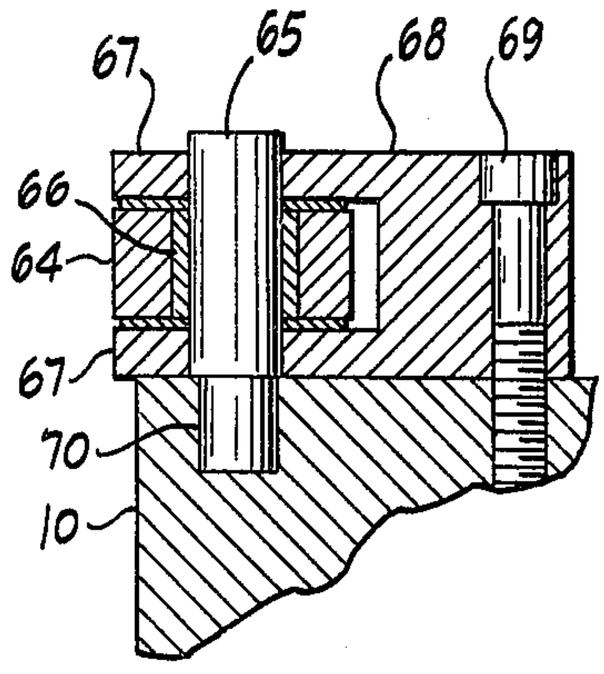

Fig. 4

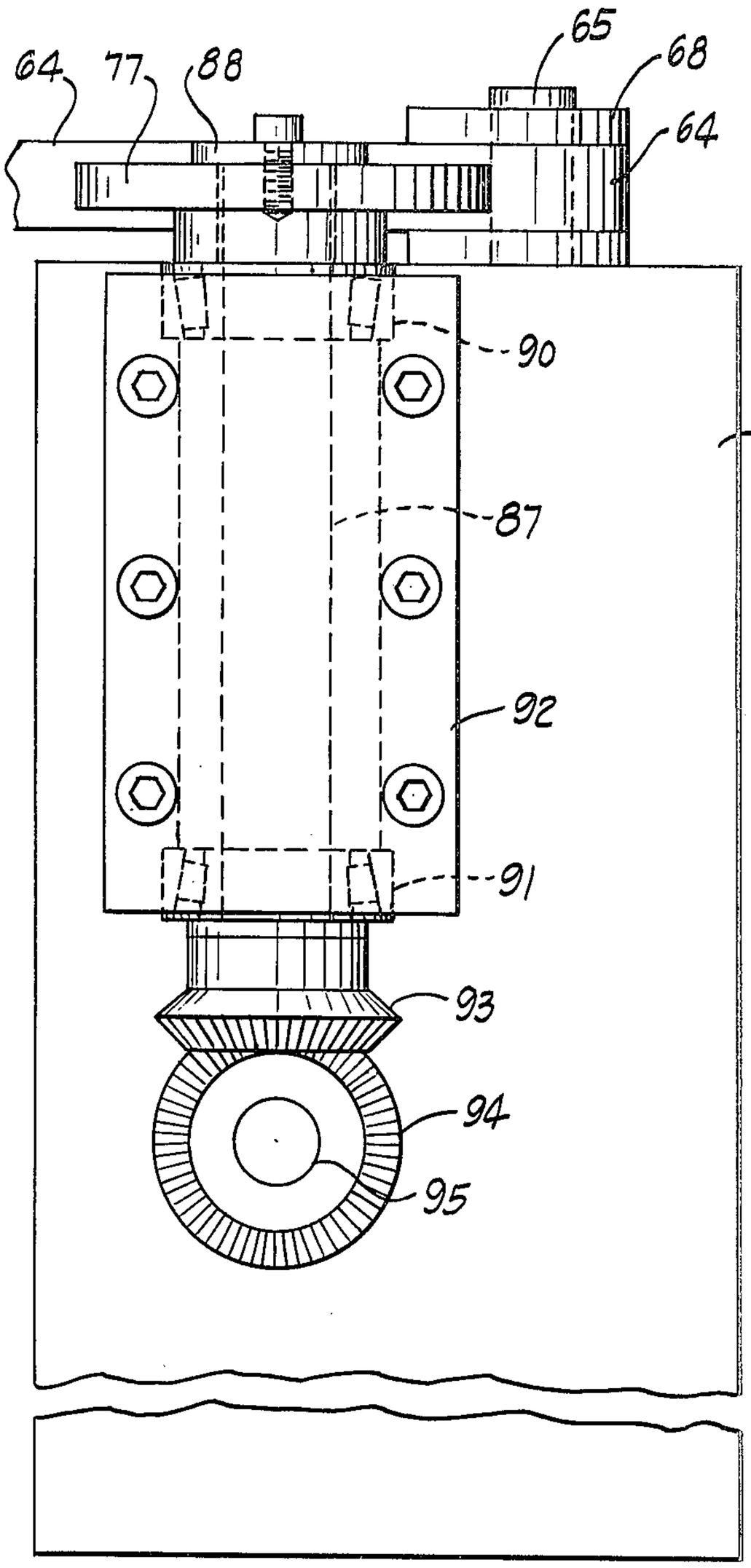
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Fig. 5

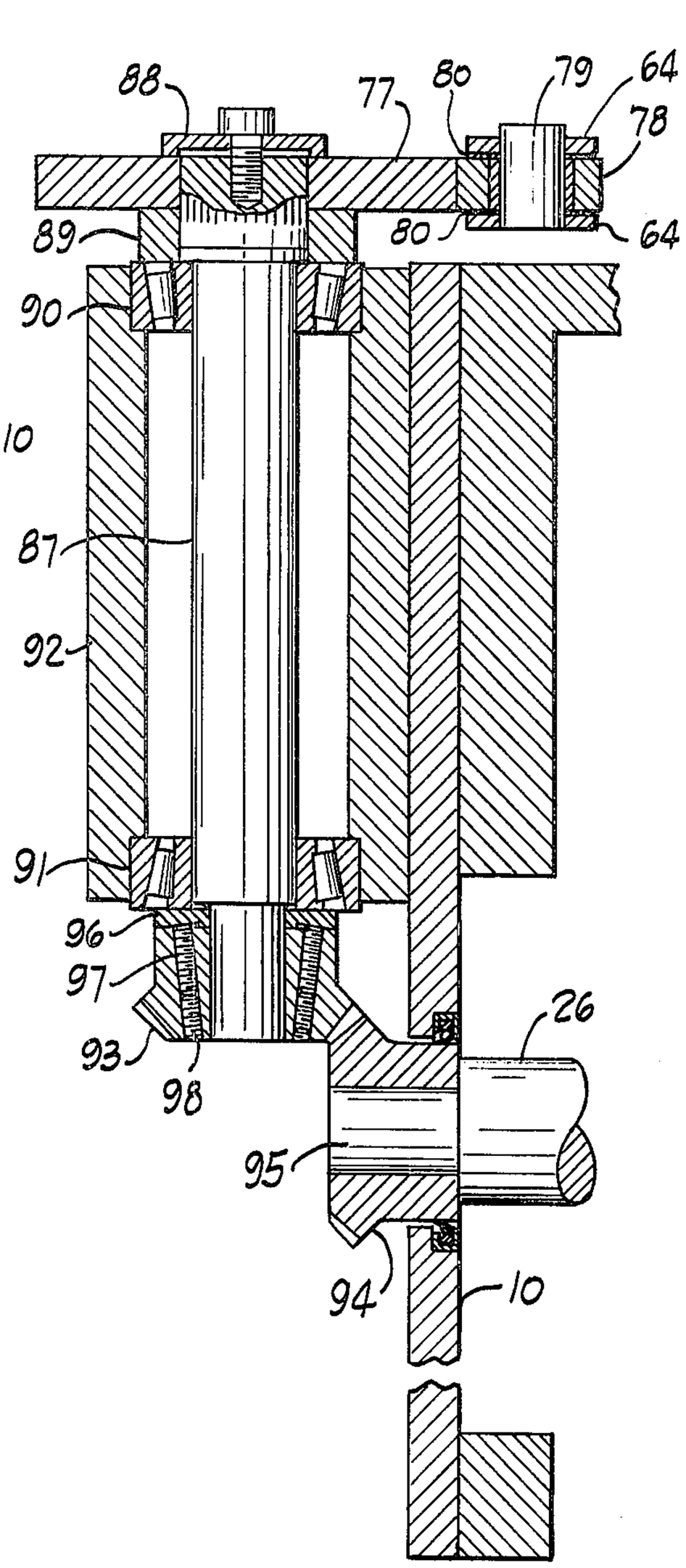
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Fig. 6

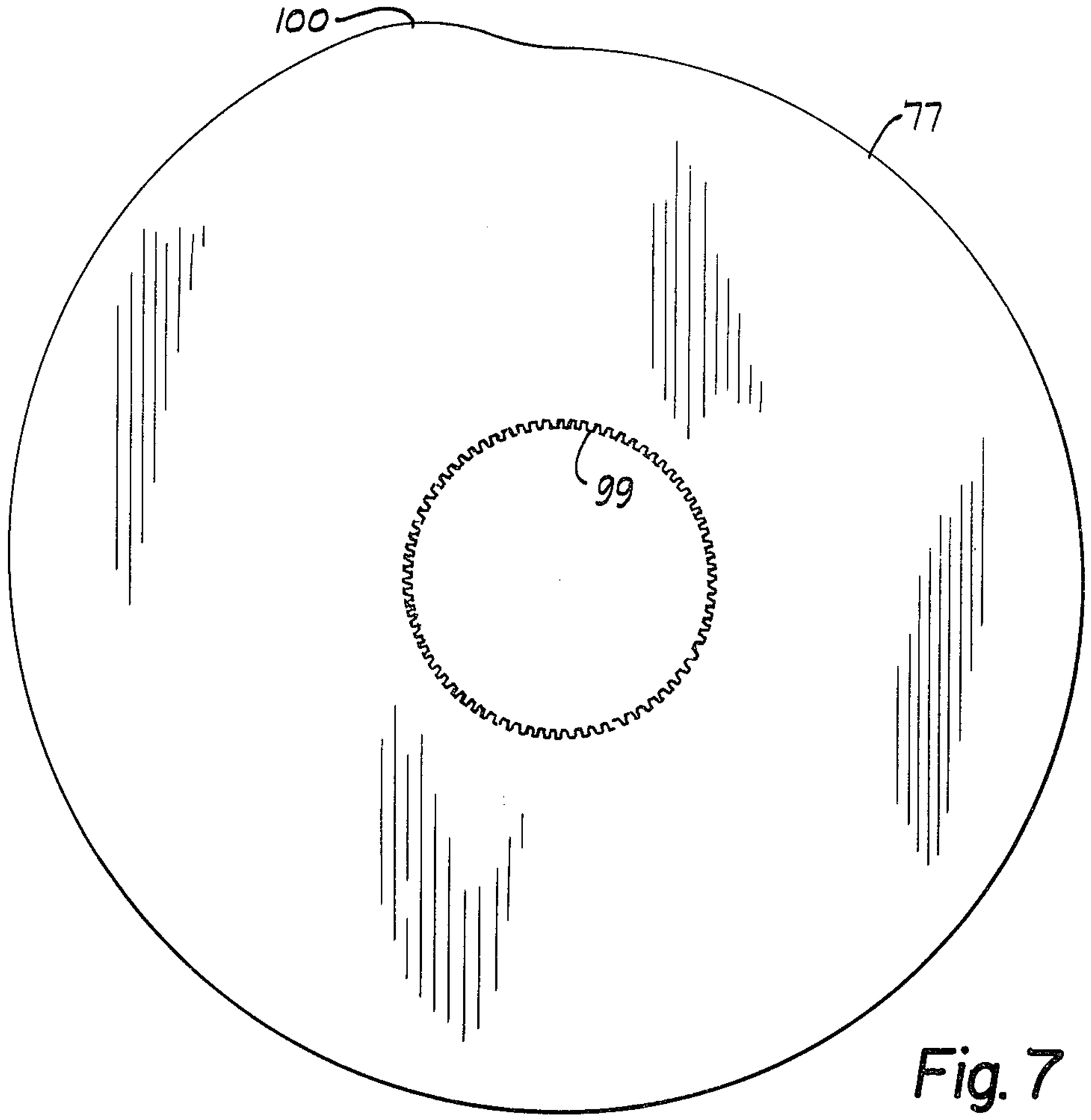

Fig. 7

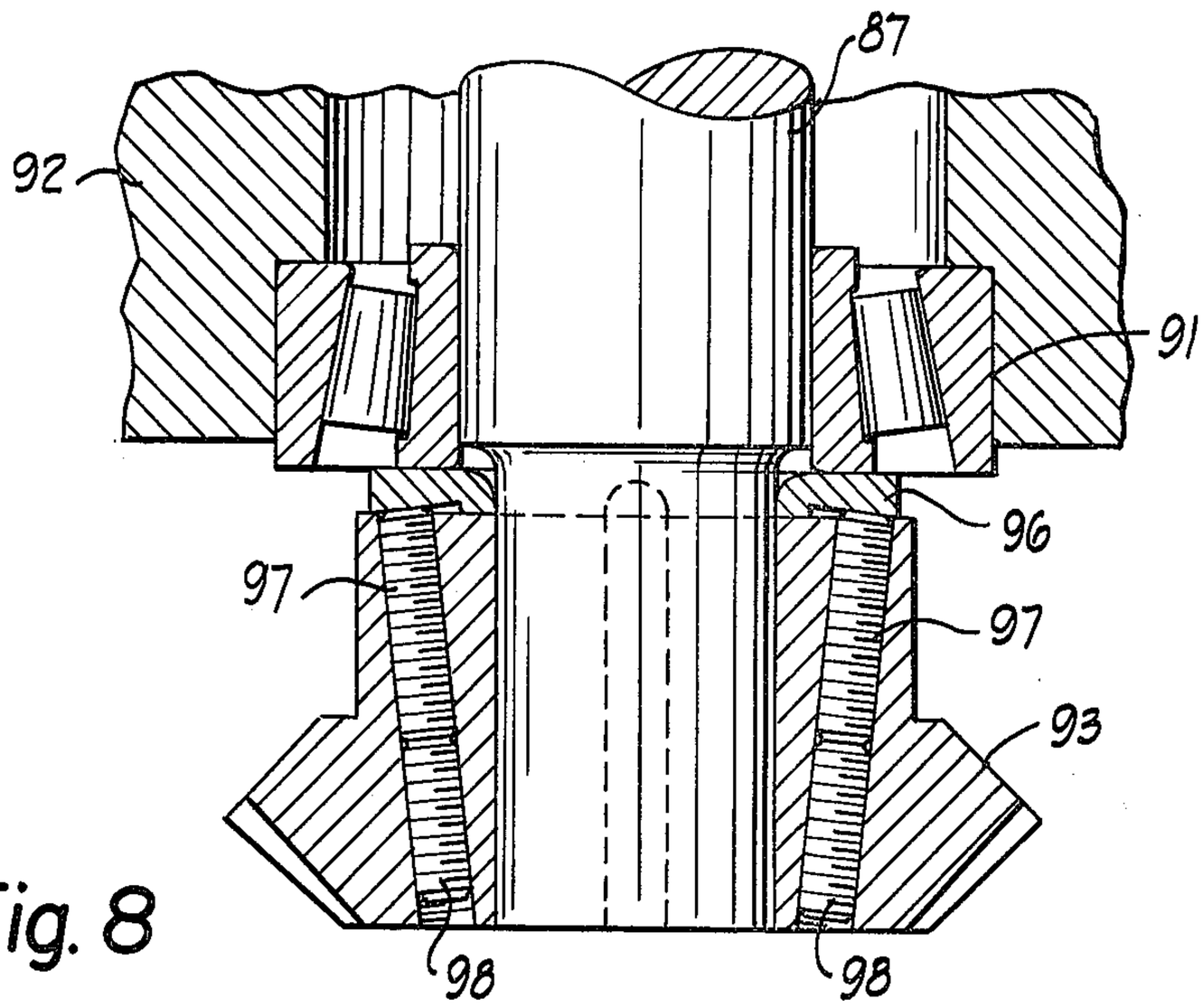

Fig. 8

PUNCH KNOCK-OUT MECHANISM FOR HEADER

RELATED CASE

This application is a continuation of my copending application Ser. No. 659,658 filed Feb. 20, 1976, now abandoned, entitled PUNCH KNOCK-OUT MECHANISM FOR DOUBLE-BLOW HEADER the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to header machines, and more specifically to the punch knock-out mechanism thereof.

2. Description of the Prior Art

Cold heading machines are conventionally provided with punch knock-out mechanism in order to insure that the blank being headed will remain in the die as the punch slide recedes from the die after a heading blow. One such mechanism is disclosed in U.S. Pat. No. 3,127,626, issued Apr. 7, 1964.

The typical punch knock-out mechanisms of the prior art are relatively complex assemblages of linkages, rocker arms, pivots, reciprocating rods and/or cams, etc. The large number of parts making up the mechanism have prevented their successful use in the smaller size headers, such as $\frac{1}{8}$ inch and 3/16 inch machines, which operate at high speeds. Another difficulty is that the prior art mechanisms require frequent repair to keep them in operation.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a new and improved mechanism for actuating the punch knock-out mechanism of a header punch assembly which mechanism overcomes the foregoing difficulties and disadvantages of the prior art and which is capable of performing the required movements at high speeds.

Another object of the present invention is to provide a timed, positive punch knock-out actuating mechanism as described above characterized by a simplified construction consisting of fewer parts then conventional mechanisms.

A further object of the present invention is to provide a punch knock-out actuating mechanism as described above which can be easily adapted to existing headers.

Still another object of the invention is to provide a new and improved trouble-free punch knock-out actuating mechanism as described above which is not subject to the maintenance problems that have been encountered in the past.

The foregoing objects are achieved and the disadvantages of the prior art are overcome by the provision of a novel punch knock-out actuating mechanism for a header comprising a reciprocal rod mounted on the frame of the machine for movement lengthwise of the path of movement of the punch slide and in position to engage the knock-out mechanism of a work-aligned punch assembly, a lever pivoted on the frame of the header for moving the rod and causing it to actuate the knock-out mechanisms of the punch assembly, and a rotatable timing cam driven from the crankshaft of the header for pivoting the lever and thereby actuating the rod when the header tool or punch slide recedes from the fixed die.

In accordance with a preferred embodiment of the invention, the timing of the cam can be adjusted, whereby the punch knock-out actuating mechanism of the present invention can be readily installed on different existing headers. Another feature is the simplicity of the new mechanism. Because of the absence of the multiple number of cams, linkages, pivots, etc. characterizing prior art punch knock-out actuating mechanisms, the mechanism of the present invention can operate at high speeds heretofore not considered practical and can be installed and used successfully on small headers.

Other objects, advantages and a fuller understanding of the invention will be had from the following detailed description of a preferred embodiment and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view with portions broken away showing a double-blow cold header of conventional construction incorporating the present invention;

FIG. **2** is an enlarged, fragmentary plan view of a portion of the structure shown in FIG. **1**;

FIG. **3** is a fragmentary cross-sectional view taken on the line **3—3** of FIG. **2**;

FIG. **4** is a fragmentary cross-sectional view taken on the line **4—4** of FIG. **2**;

FIG. **5** is a fragmentary elevational view of a portion of the punch knock-out actuating mechanism;

FIG. **6** is a vertical cross-section of the structure shown in FIG. **5**;

FIG. **7** us an enlarged plan view of a timing cam which forms a part of the punch knock-out actuating mechanism; and,

FIG. **8** is an enlarged fragmentary view of a portion of the structure shown in FIG. **6**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, and to FIG. **1** in particular, there is shown a double-blow header comprising a bed or frame **10** which supports a horizontally reciprocal tool or punch slide **11** and a fixed die breast **12**. A shiftable tool or punch carrier **13** is mounted on the slide **11** and carries a pair of punch assemblies including punch blocks **14, 15**. Cold heading punches **16, 17** are supported in the punch blocks **14, 15**, respectively, for alternate cooperation with a single die **18** mounted in the die breast **12**.

The slide **11** is reciprocated toward and away from the die breast **12** by a connecting rod **23** and a cooperating crank **24** on the main crankshaft **25**. The crankshaft **25** is suitably mounted in the frame **10** and driven in a conventional manner. Also mounted in the frame **10** is a shaft **26** which operates the stock shear and transfer mechanism, the die knock-out mechanism the punch knock-out actuating mechanism of the present invention, and the mechanism (not shown) for shifting or oscillating the punch carrier **13** between its two alternate positions in which one or the other of the punches **16** or **17** is aligned with the die **18**. The shaft **26** in the depicted header is driven at one-half the speed of the crank-shaft **25** by a pinion **27** on the crank-shaft **25** in mesh with a gear **28** on a shaft **29**. The shaft **29** carries a bevel gear **30** in mesh with a bevel gear **31** on the shaft **26**.

Wire stock **32** is fed to a shear and transfer mechanism generally designated by reference numeral **33** which operates to cut blanks of measured length and

successively transfer them to a position in front of the die **18**. As will be understood by those familiar with double-blow cold headers, a blank is positioned in the die **18** on every other stroke of the slide **11**. When a new blank has been positioned in the die **18**, the tool slide is driven forward to effect a first or preliminary upsetting blow on the blank. Following the first heading blow, the slide **11** retracts and the punch carrier **13** shifted to align the punch **17** with the die **18**. The slide **11** is then driven forward a second time to effect a second or final heading blow on the blank. After the heading operation is completed, the header slide **11** retracts, a new blank is aligned with the die **18** and the tool carrier **13** shifted to bring the first punch **16** into alignment with the die **18** for the next operating cycle.

As shown most clearly in FIG. **3**, the punch block **14** is provided with a lever **40** which is mounted by a pivot pin **41**. One end **42** of the lever **40** extends into a pocket **43** formed in the punch block **14** and engages the inner end of a longitudinally movable knock-out pin **44** extending within the punch **16**. The other end **45** of the lever extends outwardly from the punch block **14** and has a cam surface engageable by a member of a knock-out actuating mechanism to pivot the lever **40** clockwise, as viewed in FIG. **3**, so that the opposite end **42** of the lever will push the knock-out pin **44** forwardly in the punch **16**, that is, toward the die **18**, in timed relation to the retraction of the punch **16** from the die.

In the depicted header, the knock-out pin **44** has a head **47**, a forwardly projecting hexagonal shank **48** and a rearwardly extending portion **49** engageable by the lever **40**. The head **47** is engageable with longitudinally spaced shoulders or walls in the pocket **43** to limit forward and rearward movement of the pin. In the rearward position shown in FIG. **3**, the end of the shank **48** is withdrawn inside the punch **16** to provide a hexagonal cavity **50** in which the head of the blank (not shown) is formed by the heading blows. The shank of the blank is received in the cavity **51** of the die **18** against the end of the movable knock-out pin **52**. The pin **52** remains stationery during the heading blows to provide a fixed abutment for the inner end of the blank. It will be understood that various knock-out pins and punch and die assemblies can be substituted for the ones shown in the drawings without departing from the invention.

As shown in FIG. **1**, a lever **60** is pivotally mounted in the punch holder **15** in the same manner as the lever **40**. The lever **60** is associated with a knock-out pin (not shown) in the punch **17** similar to the knock-out pin **44**.

It will be understood that the apparatus and the operation thus far described is conventional and has been described without limitation of the invention simply to disclose one exemplary machine in which the invention can be used to advantage. Reference is made to U.S. Pat. Nos. 3,200,424 and 3,127,626 for a more detailed description of the parts of the exemplary machine heretofore referred to. As will be hereafter made more apparent, the punch knock-out actuating mechanism of this invention is such that it can be readily installed on other types of headers.

In accordance with the present invention, at least one and preferably both of the knock-out mechanisms of the punch assemblies including the punches **16, 17** are actuated by the shaft **26** in timed relation to movement of the slide **11**. The knock-outs insure that the blank will be maintained in the die **18** when the slide **11** and the punch then aligned with the die recedes from the die after a heading blow rather than being frictionally retained in the punch.

According to the present invention a rod **46** is arranged to engage the cam end of one, preferably both of the knock-out pin lever **40** or **60** of the punch assemblies alignable with the die **18** in timed relation to the movement of the tool or punch slide **11**. In the depicted header the knock-out punch actuating mechanism of the present invention actuates the knock-out mechanisms of the punch assembly including the punch **16**. Referring particularly to FIGS. **2** and **3**, the rod **46** is shown to be reciprocally mounted for movement lengthwise of the path of movement of the slide **11** in a housing **61** fixed as by screws to the top of the die breast **12**. The rod **46** has a head **62** on its end opposite to the slide **11** and is biased in the direction of the slide **11** by a compression spring **63**. The spring **63** is received within a recess of the housing **61** and is engaged between the inner end wall of the recess and the head **62**.

A lever **64** is pivotally mounted on the top the frame **10** for moving the rod **46** in the direction of the slide **11**. As shown most clearly in FIGS. **2** and **4**, the end of the lever **64** remote from the rod **46** is journalled on a pivot pin **65** by a sleeve bearing **66**. The pivot pin **65** is supported by the legs **64** of a bifurcated bracket **68** that is fixed to the top of the frame **10** by screws **69**. The pin **65** has a reduced diameter lower end portion **70** received in a hole in the frame **10**. The other end of the lever **64** has a depending portion **71** which engages the head **62** of the rod **46**.

Swinging movement is imparted to the arm **64** by a timing cam **77** which engages a roller **78** in an aperture in the arm **64** intermediate its ends. The roller **78** is journalled on a pin **79** which is held in place on the arm **64** by washers **80**. A spring-pressed plunger **81** urges the arm **64** counterclockwise, as viewed in FIG. **2**, to maintain the roller **78** in engagement with the cam **77**. The plunger **81** is reciprocally mounted in a block **82** detachably secured as by screws to the top of the die breast **12** and is pressed against the arm **64** by a spring **83** contained within the block.

The cam **77** is detachably fixed to the top of a rotatable shaft **87** between a washer **88** and a spacer **89**. The cam shaft **87** is mounted for rotation by upper and lower roller bearing assemblies **90, 91**, respectively, within a vertical bearing mount **92** secured as by screws to the end of the frame **10** opposite to the crankshaft. A bevel gear **93** is mounted on the lower end of the cam shaft **87** in meshing engagement with a bevel gear **94** on an end portion **95** of the shaft **26**. The lower roller bearing assembly **91** is held in place by a retaining ring **96** which is acted on by screws **97** carried in the bevel gear **93**. The adjustable screws **97** are locked in place by locking screws **98**.

The action of the cam **77** is timed to swing the arm **64** clockwise, as viewed in FIG. **2**, and actuate the punch knock-out mechanism of the punch assembly as the header slide **11** recedes from the die breast. It will be understood that it may be desired to change the timing of the punch knock-out actuating mechanism depending upon the operating speed of the particular machine on which the new punch knock-out actuating mechanism of this invention is installed. To this end, the upper end of the cam shaft **87** is splined and the inner diameter of the cam is formed with a desired number of spline-engaging teeth **99** (FIG. **7**). In a preferred construction, the cam **77** has **82** teeth to provide timing in 4.39° increments.

The operation of the punch knock-out actuating mechanism of the invention will be largely apparent from the foregoing description. In summary, during movement of the punch slide **11** away from the die breast **12**, the lobe **100** of the cam **77** is rotated into engagement with the roller **78** on the lever **64**. This causes the lever **64** to swing clockwise as viewed in FIG. **2** and move the rod **46** toward the receding slide **11**. The shape of the cam **77** is such that the rod **46** overtakes the slide **11** and rocks the knock-out lever of the die assembly which lever is in the path of the rod, e.g., the lever **40** in FIG. **3**, whereby the knock-out pin is moved forwardly in the punch to insure that the blank is released and maintained in the die **18**.

It will be seen that the invention achieves the objective of providing a knock-out mechanism which is especially adapted for use in conjunction with small, double-blow high speed cold headers. The mechanism is characterized by a simplified arrangement of a limited number of parts which avoids the complex construction of linkages, pivots and cams presently found in conventional knock-out mechanisms. The new simplified construction makes it possible to transmit the required motion at high speeds heretofore not possible.

Many variations and modifications of the invention will be apparent to those skilled in the art in view of the foregoing detailed disclosure. Therefore, it is to be understood that, within the scope of the appended claimes, the invention can be practiced otherwise than as specifically shown and described.

What is claimed is:

1. In a header having a frame including a fixed die support, a tool slide supported by the frame for lineal movement toward and away from the die support, a crankshaft rotatably supported by the frame and operably connected to the tool slide for reciprocating the tool slide toward and away from the die support, a punch assembly carried by the tool slide including a punch aligned with a die carried by the die support and a punch knock-out pin and a pivoted punch knock-out lever for advancing the punch knock-out pin when moved in one direction about its pivot, a knock-out actuating shaft driven by the crankshaft and extending parallel with the path of movement of the tool slide, a knock-out lever actuating mechanism comprising: a first housing, a rod slidably supported by said housing and extending from one side thereof, means for connecting said first housing to the frame of the header adjacent to the die support with said rod slidably supported thereby extending toward the tool slide and in alignment with and in position when moved in one direction to contact the knock-out lever of the punch assembly of the header, a spring acting on said rod to urge it in the direction opposite to said one direction, a lever pivotally connected to the frame of the header and having one end engaged with said rod for moving said rod against the force of said spring, the other end of said lever being connected to the frame of the header, a second housing, means for connecting said second housing to the frame of the header, a cam shaft rotatably supported by said second housing, gearing on said cam shaft for connection to the knock-out actuating shaft of the header, a cam on said cam shaft for moving said lever about its pivot for moving said rod in said one direction in timed relation to the movement of said tool slide to engage the knock-out lever of the punch assembly of the header as the tool slide moves away from the die support.

2. In a header having a frame including a fixed die support, a tool slide supported by the frame for lineal movement toward and away from the die support, a crankshaft rotatably supported by the frame and operably connected to the tool slide for reciprocating the tool slide toward and away from the die support, a punch carrier movably supported on the tool slide, a plurality of punch assemblies carried by said punch carrier, each of said punch assemblies including a punch and a punch knock-out pin and a pivoted punch knock-out lever for advancing the punch knock-out pin when moved in one direction about its pivot, mechanism for sequentially aligning punches carried by the punch assemblies with a die carried by the die support, a knock-out actuating shaft driven by the crankshaft and extending parallel with the path of movement of the tool slide, a knock-out lever actuating mechanism comprising: a first housing, a rod slidably supported by said housing and extending from one side thereof, means for connecting said first housing to the frame of the header adjacent to the die support with said rod slidably supported thereby extending toward the tool slide and in alignment with and in position when moved in one direction to contact the knock-out lever of a punch assembly in alignment with a die in the die support, a spring acting on said rod to urge it in the direction opposite to said one direction, a lever pivotally connected to the frame of the header and having one end engaged with said rod for moving said rod against the force of said spring, means for connecting the other end of said lever to the frame of the header, a second housing, means for connecting said second housing to the frame of the header, a cam shaft rotatably supported by said second housing, gearing on said cam shaft for connection to the knock-out actuating shaft of the header, a cam on said cam shaft for moving said lever about its pivot for moving said rod in said one direction in timed relation to the movement of said tool slide to engage the knock-out lever of the punch assembly of the header aligned therewith as the tool slide moves away from the die support.

3. In a header having a frame including a fixed die support, a tool slide supported by the frame for lineal movement toward and away from the die support, a crankshaft rotatably supported by the frame and operably connected to the tool slide for reciprocating the tool slide toward and away from the die support, a punch assembly carried by the tool slide including a punch aligned with a die carried by the die support and a punch knock-out pin and a pivoted punch knock-out lever for advancing the punch knock-out pin when moved in one direction about its pivot, a knock-out actuating shaft driven by the crankshaft and extending parallel with the path of movement of the tool slide, a knock-out lever actuating mechanism comprising: a first housing, a rod slidably supported by said housing and extending from one side thereof, means for connecting said first housing to the top of the frame of the header adjacent to the die support with said rod slidably supported thereby extending toward the tool slide and in alignment with and in position when moved in one direction to contact the knock-out lever of the punch assembly of the header, a spring acting on said rod to urge it in the direction opposite to said one direction, a lever pivotally connected to the top of the frame of the header and having one end engaged with said rod for moving said rod against the force of said spring, means for connecting the other end of said lever to the top of the frame of the header, a second housing, means for

connecting said second housing to the end of the frame of the header at which the die support is located, a cam shaft rotatably supported by said second housing, gearing on said cam shaft for connection to the knock-out actuating shaft of the header, a cam on said cam shaft for moving said lever about its pivot for moving said rod in said one direction in timed relation to the movement of said tool slide to engage the knock-out lever of the punch assembly of the header as the tool slide moves away from the die support.

4. In a header having a frame including a fixed die support, a tool slide supported by the frame for lineal movement toward and away from the die support, a crankshaft rotatably supported by the frame and operably connected to the tool slide for reciprocating the tool slide toward and away from the die support, a punch carrier movably supported on the tool slide, a plurality of punch assemblies carried by the punch carrier, each of the punch assemblies including a punch and a punch knock-out pin and a pivoted punch knock-out lever for advancing the punch knock-out pin when moved in one direction about its pivot, mechanism for sequentially aligning punches carried by the punch assemblies with a die carried by the die support, a knock-out actuating shaft driven by the crankshaft and extending parallel with the path of movement of the tool slide, a knock-out lever actuating mechanism comprising: a first housing, a rod slidably supported by said housing and extending from one side thereof, means for connecting said first housing to the top of the frame of the header adjacent to the die support with said rod slidably supported thereby extending toward the tool slide and in alignment with and in position when moved in one direction to contact the knock-out lever of a punch assembly in alignment with a die in the die support, a spring acting on said rod to urge it in the direction opposite to said one direction, a lever pivotally connected to the top of the frame of the header and having one end engaged with said rod for moving said rod against the force of said spring, means for connecting the other end of said lever to the top of the frame of the header, a second housing, means for connecting said second housing to the end of the frame of the header adjacent to the die support, a cam shaft rotatably supported by said second housing, gearing on said cam shaft for connection to the knock-out actuating shaft of the header, a cam on said cam shaft for moving said lever about its pivot for moving said rod in said one direction in timed relation to the movement of said tool slide to engage the knock-out lever of the punch assembly of the header aligned therewith as the tool slide moves away from the die support.

5. A device as claimed in claim 1 including means for angularly adjusting the cam relative to the cam shaft.

6. A device as claimed in claim 2 including means for angularly adjusting the cam relative to the cam shaft.

7. A device as claimed in claim 3 including means for angularly adjusting the cam relative to the cam shaft.

8. A device as claimed in claim 4 including means for angularly adjusting the cam relative to the cam shaft.

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